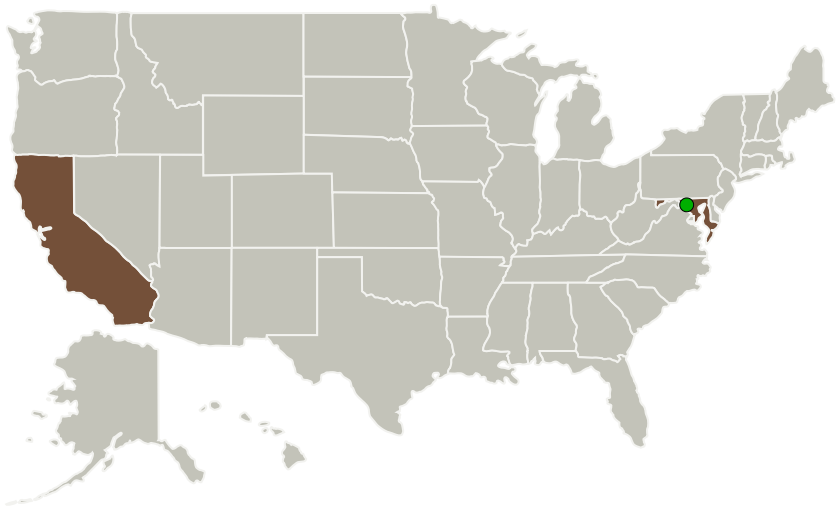
Space Mission Design in the Vicinity of Small Bodies and Libration Points, Phase I

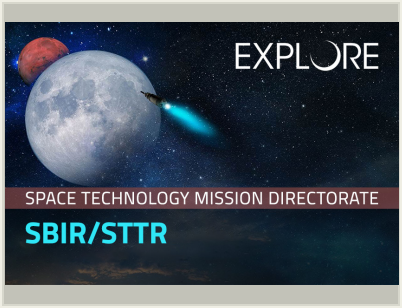
Completed Technology Project (2011 - 2011)

Project Introduction

To address NASA's need for applying advanced dynamical theories to space mission design and analysis, especially in the context of unstable orbital trajectories in the vicinity of small bodies and libration points, Physical Optics Corporation (POC) proposes to develop a novel advanced Orbit Dynamic Computation Approach for Space Mission Analysis in the Vicinity of Small Bodies and Libration Points (ODYBOLP), with corresponding computational algorithms and software based on advanced models of complicated celestial dynamical systems with libration points (LPs) and a pseudo-arclength continuation method for computation of periodic orbits in such systems. The ODYBOLP approach will enable users to analyze space missions using: (a) all possible stable and unstable periodic orbits near LPs of Sun-Earth and Earth-Moon systems, etc.; (b) all possible periodic orbits near asteroids and comets; (c) possible dynamic transitions between different orbits connecting them to each other to organize space for near-zero fuel cost passageways through such orbits. The ODYBOLP software will be integrated into standard NASA software (GMAT, JAT, etc.) for mission analysis and design. In Phase I, POC will demonstrate the feasibility of the ODYBOLP approach. In Phase II, POC will develop a fully functional software system and demonstrate its complete feasibility.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Physical Optics Corporation	Lead Organization	Industry	Torrance, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Transitions

February 2011: Project Start

August 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138520)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Physical Optics Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Victor Grubsky

Co-Investigator:

Volodymyr Romanov

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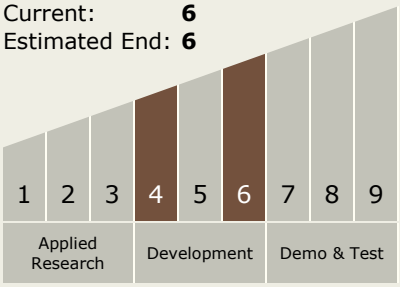
Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.6 Rendezvous, Proximity Operations, and Capture Trajectory Design and Orbit Determination

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System